National Science Bowl® Middle School Electric Car Competition

Design Interview Guidelines and Rubric

Judging teams will be interviewing each team and asking a series of questions on how the car was engineered based on the materials provided. In addition, each team will describe their own creative design, cost savings strategy and marketability plan for scale up manufacturing to make their car a product that the Dabman™ Toy Company will want to include in their toy line. Judges will be evaluating teams on marketing, engineering, and business management aspects and in their ability to use required materials, utilize repurposed and recycled consumer materials, create consumer marketability, develop high performance features, lower production costs and optimize an efficient manufacturing process. Teams need to bring their completed cars to the interview since the judging teams will also be visually inspecting the cars.

Interview Scenario:

About the Dabman™ Toy Company

From the 1950's the Dabman™ Toy Company started out as a one-room store-front shop in Colorado making wooden rockets. The company has now evolved to offer a variety of innovative car products making it a Fortune 500 toy company. Dabman™ Toys has captured the hearts and minds of millions and has become an international phenomenon. While the focus has changed throughout the years, Dabman™ Toys has redesigned its product line with toys that are enjoyable for children, have educational benefits for the child and are a good value for the purchaser.

Dabman™ and the Lithium-ion Battery-Powered Model Car

Dabman™ is excited about their new product line of wooden lithium-ion battery powered model cars. Lithium-ion batteries is the future technology for the United States to power hybrid and electric cars, while enhancing energy security, reducing petroleum dependence and lowering emissions. These toys will let children test out a novel and green technology that already powers cell phones, cameras, and computers. Market analysis has shown that there is a 64% increase in interest of children from the ages of 11-14 in designing and racing model cars and Dabman™ wants to capture this audience with a new model car. The battery technology is exciting with the lithium-ion battery providing lighter weight, denser energy storage with a ten-to-fifteen year lifetime and high performance. Dabman™ is hoping to inspire the next generation of scientists and drivers to find the breakthrough technology to help meet the nation's goal of 1 million electric cars on the road by 2015.

Components:

1) Use of Required Materials

Dabman™ Toys wants the model car to include their company's following proven components as part of the design:

- E-flite 3.7V 150 mAh, 25c, Lithium Polymer Battery
- Mabuchi 280 motor
- Battery connector: model PKZ3052
- 2 LED lights
- Balsa wood from the teacher kit must be used for the chassis
- On/Off switch

2) Use of Repurposed and Recycled Consumer Materials

In order to minimize production costs and reduce the environmental impact and energy consumption required in manufacturing from raw materials, components of the car are to be made as much as possible from repurposed and recycled consumer materials. These are cheaply obtainable pre-consumer materials that are able to be utilized by altering their original purpose rather than going to waste. Examples include using CDs as wheels, tape deck parts for the drive train, and shipping materials to construct the outer body of the car. Winning designs will require less fabrication to modify these materials for the construction of the car.

3) Consumer Marketability

Dabman™ Toys places a high importance on the car being framed with an aesthetic outer body (See Figure 1). Consumers will find it fun and cool to have an authentic resemblance to a real, full sized car. Features to consider in the aesthetics of the outer body could include windshields, fenders, doors, headlights, hub caps, side mirrors, bumpers, or a license plate. Dabman™ also recognizes that effective branding contributes to marketability. Consequently, judging teams will be looking for creative display of a product emblem that is characteristic of the car.

Figure 1: Framed and Unframed Car Examples

4) High Performance Features

Dabman™ wants to demonstrate the capability of Lithium-ion Battery power by offering an exciting car with high performance features. Judging teams will be inspecting car specifications that contribute to performance such as low total weight, an effective gear ratio or a unique aerodynamic structural design providing stable support to the salt container.

5) Production Cost & Manufacturing Feasibility

In order to effectively mass market the car to consumers, Dabman™ must select a model car that is cheap and simple to build. Judging teams will be estimating the relative ease in reproducing the car by assessing the cost of the parts and time/difficulty needed to construct the car. Winning designs will reduce cost by incorporating repurposed and recycled consumer materials and simplistic manufacturing. In addition to visually inspecting the car, judges will refer to the cost assessment submitted in component 9 of the Engineering Design Document (see Engineering Design Document Guidelines).

6) Teamwork

The Dabman™ judging team would like to see evidence that it is investing in a design team that is able to adapt to ongoing engineering challenges and improve existing performance by working in a collaborative group composed of individuals who equally contribute and work well to together. Design teams should demonstrate this potential for effective collaboration by discussing what roles each person had in the team, how they arrived at design choices, and give examples of challenges they overcame as a group while designing, building, and testing the prototype car.

7) Fielding of Questions

Each team should be able to clearly demonstrate knowledge in the design and construction of their car and give examples of their responses by either referring to the car or past experiences during its development.

Design Interview Rubric

School Name_____

All teams must bring their cars to the Design Interview and be prepared to answer questions on the car design.

Components	Points Awarded				Score	Comments
1) Use of Required Materials Car includes required Dabman™ components.	*Required Materials* 3 POINTS			*Not All Of The Required Materials* 0 POINTS		
2) Use of Repurposed and Recycled Consumer Materials Used repurposed and recycled consumer materials requiring minimal modification.	*Exceptional* 5 POINTS	*Exceeds Expectations* 4 POINTS	*Meets Expectations* 3 POINTS	*Does not meet expectations* 0 POINTS		
3) Consumer Marketability Has an aesthetic outer body design and a creative display of a product emblem	*Exceptional* 4 POINTS	*Exceeds Expectations* 3 POINTS	*Meets Expectations* 2 POINTS	*Does not meet expectations* 0 POINTS		
4) High Performance Features Design includes high performance features	*Exceptional* 4 POINTS	*Exceeds Expectations* 3 POINTS	*Meets Expectations* 2 POINTS	*Does not meet expectations* 0 POINTS		
5) Production Cost & Manufacturing Feasibility Made from inexpensive materials and easy construction that allows for scale up manufacturing	*Exceptional* 5 POINTS	*Exceeds Expectations* 4 POINTS	*Meets Expectations* 3 POINTS	*Does not meet expectations* 0 POINTS		
6) Teamwork Team demonstrates collaboration and equal contribution	*Exceptional* 4 POINTS	*Exceeds Expectations* 3 POINTS	*Meets Expectations* 2 POINTS	*Does not meet expectations* 0 POINTS		
7) Fielding of Questions Responses to questions were articulate and well informed	*Exceptional* 5 POINTS	*Exceeds Expectations* 4 POINTS	*Meets Expectations* 3 POINTS	*Does not meet expectations* 0 POINTS		
*JUDGE*_____				*TOTAL*		__/30